For a directory of public training programs for mobile heavy equipment mechanics, contact:

☛ SkillsUSA-VICA, P.O. Box 3000, 1401 James Monroe Hwy., Leesburg, VA 22075. Telephone (toll free): 1-800-321-VICA.
Internet: **http://www.skillsusa.org**

A list of certified diesel mechanic training programs can be obtained from:

☛ National Automotive Technician Education Foundation (NATEF), 13505 Dulles Technology Dr., Herndon, VA 20171-3421.
Internet: **http://www.natef.org**

Information on certification as a heavy-duty diesel mechanic is available from:

☛ Automotive Service Excellence (ASE), 13505 Dulles Technology Dr., Herndon, VA 20171-3421.
Internet: **http://www.asecert.org**

Motorcycle, Boat, and Small-Engine Mechanics

(O*NET 85116B, 85308, 85328A, and 85328B)

Significant Points

- Employment is expected to grow slowly, but persons with formal mechanic training should enjoy good job prospects.
- Because the use of motorcycles, boats, and outdoor power equipment is seasonal in many areas, mechanics may service other types of equipment or work reduced hours in the winter.

Nature of the Work

Though smaller, engines powering motorcycles, boats, and lawn and garden equipment share many characteristics with their larger counterparts, including breakdowns. Motorcycle, boat, and small-engine mechanics repair and service power equipment ranging from racing motorcycles to chain saws.

Small engines, like large engines, require periodic service to minimize the chance of breakdowns and to keep them operating at peak performance. During routine equipment maintenance, mechanics follow a checklist including the inspection and cleaning of brakes, electrical systems, plugs, carburetors, and other parts. Following inspection, mechanics usually repair or adjust parts that do not work properly, or replace unfixable parts. Routine maintenance is normally a major part of the mechanic's work.

When equipment breakdowns occur, mechanics use various techniques to diagnose the source and extent of the problem. The mark of a skilled mechanic is the ability to diagnose mechanical, fuel, and electrical problems, and to make repairs in a minimal amount of time. Quick and accurate diagnosis requires problem-solving ability and a thorough knowledge of the equipment's operation.

In larger repair shops, mechanics may use special computerized diagnostic testing equipment as a preliminary tool in analyzing equipment. These computers provide a systematic performance report of various components to compare them to normal ratings. After pinpointing the problem, the mechanic makes the needed adjustments, repairs, or replacements. Some jobs require minor adjustments or the replacement of a single item, such as a carburetor or fuel pump. In contrast, a complete engine overhaul requires a number of hours to disassemble the engine and replace worn valves, pistons, bearings, and other internal parts. Some highly skilled mechanics use highly specialized components and the latest computerized equipment to customize and tune motorcycles and boats for racing.

Motorcycle, boat, and small-engine mechanics use common handtools such as wrenches, pliers, and screwdrivers. They also use power tools, such as drills and grinders when customized repairs warrant.

Motorcycle, boat, and small engine mechanics follow a checklist, including the inspection and cleaning of engine parts during routine equipment maintenance.

Computerized engine analyzers, compression gauges, ammeters and voltmeters, and other testing devices help mechanics locate faulty parts and tune engines. Hoists may be used to lift heavy equipment such as motorcycles, snowmobiles, or boats. Mechanics often refer to service manuals for detailed directions and specifications while performing repairs.

Motorcycle mechanics repair and overhaul motorcycles, motor scooters, mopeds, and all-terrain vehicles. Besides engines, they may work on transmissions, brakes, and ignition systems, and make minor body repairs. Mechanics usually specialize in the service and repair of one type of equipment, although they may work on closely related products. Mechanics may only service a few makes and models of motorcycles because usually the dealers only service the products they sell.

Boat mechanics, or *marine equipment mechanics*, repair and adjust the engines and electrical and mechanical equipment of inboard and outboard marine engines. Most small boats have portable outboard engines that are removed and brought into the repair shop. Larger craft, such as cabin cruisers and commercial fishing boats, are powered by diesel or gasoline inboard or inboard-outboard engines, which are only removed for major overhauls. Most of these repairs are performed at the docks or marinas. Boat mechanics may also work on propellers, steering mechanisms, marine plumbing, and other boat equipment.

Small-engine mechanics service and repair outdoor power equipment such as lawnmowers, garden tractors, edge trimmers, and chain saws. They may also occasionally work on portable generators and go-carts. In addition, small-engine mechanics in northern parts of the

country may work on snowblowers and snowmobiles, but demand for this type of repair is seasonal.

Working Conditions

Motorcycle, boat, and small-engine mechanics usually work in repair shops that are well lighted and ventilated, but are sometimes noisy when testing engines. However, boat mechanics may work outdoors at docks or marinas, and in all weather conditions, when making repairs aboard boats. They may work in cramped, or awkward positions to reach a boat's engine.

During the winter months in the northern United States, mechanics may work fewer than 40 hours a week because the amount of repair and service work declines when lawnmowers, boats and motorcycles are not in use. Many mechanics only work during the busy spring and summer seasons. However, many mechanics schedule time-consuming engine overhauls and work on snowmobiles and snowblowers during winter downtime. Mechanics may work considerably more than 40 hours a week when demand is strong.

Employment

Motorcycle, boat, and small-engine mechanics held about 52,000 jobs in 1998. About 14,000 were motorcycle mechanics, while the remainder specialized in the repair of boats or outdoor power equipment. Two-thirds of all motorcycle, boat, and small-engine mechanics worked for retail hardware and garden stores, or retail dealers of boats, motorcycles, and miscellaneous vehicles. Most of the remainder were employed by independent repair shops, marinas and boat yards, equipment rental companies, wholesale distributors, and landscaping services. About one-third were self-employed.

Training, Other Qualifications, and Advancement

Due to the increasing complexity of motorcycles and boats, most employers prefer to hire mechanics who graduate from formal training programs for motorcycle, marine, or small-engine mechanics. Because the number of these specialized post-secondary programs is limited, most mechanics learn their skills on the job or while working in related occupations. For trainee jobs, employers hire persons with mechanical aptitude who are knowledgeable about the fundamentals of small 2- and 4-stroke engines. Many trainees develop an interest in mechanics and acquire some basic skills through working on automobiles, motorcycles, boats, or outdoor power equipment as a hobby. Others may be introduced to mechanics through vocational automotive training in high school, or one of many post-secondary institutions.

Trainees learn routine service tasks under the guidance of experienced mechanics by replacing ignition points and spark plugs or by taking apart, assembling, and testing new equipment. As trainees gain experience and proficiency, they progress to more difficult tasks such as advanced computerized diagnosis and engine overhauls. Up to 3 years of on the job training may be necessary before a novice worker becomes competent in all aspects of the repair of motorcycle and boat engines.

Employers often send mechanics and trainees to special training courses conducted by motorcycle, boat, and outdoor power equipment manufacturers or distributors. These courses, which can last as long as 2 weeks, upgrade the worker's skills and provide information on repairing new models. They are usually a prerequisite for any mechanic who performs warranty work for manufacturers or insurance companies.

Most employers prefer to hire high school graduates for trainee mechanic positions, but will accept applicants with less education if they possess adequate reading, writing, and arithmetic skills. Many equipment dealers employ students part-time and during the summer, to help assemble new equipment and perform minor repairs. Helpful high school courses include small-engine repair, automobile mechanics, science, and business arithmetic.

Knowledge of basic electronics is essential for motorcycle, boat, and small-engine mechanics. Electronic components control engine performance, instrument displays, and a variety of other functions of motorcycles, boats, and outdoor power equipment. To recognize and fix potential problems, mechanics should be familiar with the basic principles of electronics.

The most important work possessions of mechanics are their hand tools. Mechanics usually provide their own tools and many experienced mechanics have invested thousands of dollars in them. Employers typically furnish expensive power tools, computerized engine analyzers, and other diagnostic equipment, but mechanics accumulate hand tools with experience.

The skills used as a motorcycle, boat, and small-engine mechanic generally transfer to other occupations such as automobile, truck, or heavy equipment mechanics. Experienced mechanics with leadership ability may advance to shop supervisor service manager jobs. Mechanics with sales ability sometimes become sales representatives or open their own repair shops.

Job Outlook

Employment of motorcycle, boat, and small-engine mechanics is expected to grow slower than the average for all occupations through the year 2008. The majority of job openings are expected to be replacement jobs because many experienced motorcycle, boat, and small-engine mechanics leave each year to transfer to other occupations, retire, or stop working for other reasons. Job prospects should be especially favorable for persons who complete mechanic training programs.

Growth of personal disposable income over the 1998-2008 period should provide consumers with more discretionary dollars to buy boats, lawn and garden power equipment, and motorcycles. This will require more mechanics to keep the growing amount of equipment in operation. In addition, routine service will always be a significant source of work for mechanics. While technology will lengthen the interval between check-ups, the need for qualified mechanics to perform this service will increase.

Employment of motorcycle mechanics should increase slowly as the popularity of motorcycles rebounds. Motorcycle usage should continue to be popular with persons between the ages of 18 and 24, an age group which historically has had the greatest proportion of motorcycle enthusiasts. Motorcycles are also increasingly popular with persons over the age of 40. Traditionally, this group has disposable income to spend on recreational equipment such as motorcycles and boats.

Over the next decade, more people will be entering the age group 40 and over; this group is responsible for the largest segment of marine craft purchases. These potential buyers will help expand the market for boats, while helping to maintain the demand for qualified mechanics. Construction of new single-family houses will result in an increase in the lawn and garden equipment in operation, increasing the need for mechanics. However, equipment growth will be slowed by trends toward smaller lawns and contracting out their maintenance to lawn service firms. Growth will also be tempered by the tendency of many consumers to dispose of and replace relatively inexpensive items rather than have them repaired.

Earnings

Median annual earnings of motorcycle mechanics were $23,440 in 1998. The middle 50 percent earned between $18,960 and $29,550 a year. The lowest 10 percent earned less than $13,990 and the highest 10 percent earned more than $36,760 a year.

Median annual earnings of small-engine mechanics were $21,580 in 1998. The middle 50 percent earned between $16,870 and $26,880 a year. The lowest 10 percent earned less than $13,430 and the highest 10 percent earned more than $32,780 a year.

Motorcycle, boat, and small-engine mechanics tend to receive few benefits in small shops, but those employed in larger shops often receive paid vacations, sick leave, and health insurance. Some employers also pay for work related training and provide uniforms.

Related Occupations
Mechanics and repairers who work on other types of mobile equipment powered by internal combustion engines include automotive mechanics and service technicians, diesel mechanics and service technicians, farm equipment mechanics, and mobile heavy equipment mechanics.

Sources of Additional Information
For more details about work opportunities, contact local motorcycle, boat, and lawn and garden equipment dealers, and boat yards and marinas. Local offices of the State employment service may also have information about employment and training opportunities.

General information about motorcycle mechanic careers may be obtained from:

☛ Motorcycle Mechanics Institute, 2844 West Deer Valley Rd., Phoenix, AZ 85027.

☛ American Motorcycle Institute, 3042 West International Speedway Blvd., Daytona Beach, FL 32124. Telephone (toll free): 1-800-874-0645.

General information about boat mechanic careers is available from:

☛ Marine Mechanics Institute, 2844 West Deer Valley Rd., Phoenix, AZ 85027.

☛ American Marine Institute, 3042 West International Speedway Blvd., Daytona Beach, FL 32124. Telephone (toll free): 1-800-874-0645.

General information about small-engine mechanic careers may be obtained from:

☛ Outdoor Power Equipment Institute, 341 South Patrick St., Alexandria, VA 22314.

For a list of public motorcycle, boat, and small-engine mechanic training programs, contact:

☛ SkillsUSA-VICA (Vocational Industry Clubs of America), P.O. Box 3000, 1401 James Monroe Hwy., Leesburg, VA 22075. Telephone (toll free): 1-800-321-VICA. Internet: **http://www.vica.org**

Musical Instrument Repairers and Tuners

(O*NET 85921A, 85921B, 85921C, and 85921D)

Significant Points

- Almost two-thirds of all musical instrument repairers and tuners are self-employed.
- Opportunities should be excellent for persons with formal training in piano technology or brass, woodwind, string, and electronic musical instrument repair.
- Musical instrument repairers and tuners should be able to play the instruments on which they work.

Nature of the Work
Musical instruments provide entertainment and recreation to millions of people everyday. Those who repair and tune instruments combine their love of music with a highly skilled craft to make sure that the next note played is as true as the last. Musical instrument repairers and tuners, often referred to as technicians, work in four specialties: Band instruments, pianos and organs, violins, and guitars. (Repairers and tuners who work on electronic organs are discussed in the *Handbook* statement on electronic home entertainment equipment repairers.)

Band instrument repairers work on woodwind, brass, reed, and percussion instruments damaged through deterioration or accident. Starting with the customer's description of the problem, they examine instruments and determine what must be done to restore them to proper performance levels and established industry specifications. These technicians also regularly tune and adjust instruments.

Brass and wind instrument repairers clean, adjust, and repair trumpets, cornets, french horns, trombones, tubas, clarinets, flutes, saxophones, oboes, and bassoons. They move mechanical parts or play scales to find defects. They may unscrew and remove rod pins, keys, and pistons and remove soldered parts using gas torches. They repair dents in metal instruments using mallets or burnishing tools. They fill cracks in wood instruments by inserting pinning wire and covering it with filler. Repairers also inspect instrument keys and replace worn pads and corks.

Percussion instrument repairers work on drums, cymbals, and xylophones. To repair a drum, technicians remove tension rods by hand or by using a drum key. They cut new drumheads from animal skin, stretch the skin over the rimhoops, and tuck the skin under the hoop using hand tools. To prevent a crack from advancing in a cymbal, gong, or similar instrument, repairers may drill holes at the inside edge of the crack; another technique involves cutting out sections around the cracks using shears or grinding wheels. Percussion repairers also replace the bars and wheels of xylophones.

Piano and organ repairers and tuners locate and correct an assortment of problems associated with thousands of instrument parts made from wood, steel, iron, brass, ivory, felt, and sometimes Teflon. While the piano and organ are each over 300 years old, the basic engineering of today's piano and organ was done almost 100 years ago and the methodology has changed very little since.

To diagnose problems, *piano repairers* talk with customers and examine the parts of the piano. Depending on the severity of the problem, they may replace worn parts, recondition usable parts, or completely rebuild pianos. In some cases, they may reconfigure or

Musical instrument repairers and tuners combine their love of music with a highly skilled craft to ensure that the next note played is as true as the last.